ENGINEERING, MECHANICAL (ENME)

ENME 2410 Materials Science I (4 Credits)

Atomic structure, bonding and crystal structures in solids. Diffusion and crystal defects. Thermodynamics and phase equilibria in one-, two- and three-component systems, binary phase diagrams. Kinetics and phase transformations. Specific microstructure and mechanical properties of metals, glasses, ceramics, polymers and composites. Electrical conduction: energy levels and bands, charge carriers and insulators. Semiconductors of intrinsic and extrinsic types. Laboratory projects/demonstrations. Prerequisites: PHYS 1212 and CHEM 1010 and MATH 1952.

ENME 2421 Materials Science II (3 Credits)

Atomic structure, bonding and crystal structures in solids. Diffusion and crystal defects. Thermodynamics and phase equalibria in one-, two- and three-component systems, binary phase diagrams. Kinetics and phase transformations. Specific microstructure and mechanical properties of metals, glasses, ceramics, polymers and composites. Electrical conduction: energy levels and bands, charge carriers and insulators. Semiconductors of intrinsic and extrinsic types. Laboratory projects/demonstrations. Prerequisites: ENME 2410.

ENME 2510 Statics (4 Credits)

Study of static force systems. Topics include resolution and composition of forces and moments, equilibrium of two-dimensional and threedimensional force systems, shear and moments in beams, friction, and moments of inertia. Includes a laboratory component where students will engage in hands-on projects that apply loading equilibrium, design of structures, and stress/strain. Prerequisites: MATH 1951 AND PHYS 1211.

ENME 2520 Dynamics I with Lab (4 Credits)

Particles Kinematics, Reference Frames, Coordinate Systems, Newton's Laws, Energy and Momentum, Multiparticle Systems, Collisions, Variable Mass Systems. These topics are addressed through analytical analysis, numerical simulation using Matlab, and experimental data collection. Cross listed with PHYS 2520. Corequisite: MATH 2080; Prerequisite: ENME 2510 AND MATH 2070.

ENME 2530 Dynamics II (3 Credits)

Rotating reference frames, rigid body kinematics, rigid body kinetics, Euler's Laws, inertia, energy and momentum, and three-dimensional motion. Cross listed with PHYS 2530. Prerequisites: ENME 2520.

ENME 2540 System Dynamics (3 Credits)

This course covers modeling, analysis, and control of single and multiple degree-of freedom dynamical systems, including mechanical, electrical, thermal, fluid systems and their combinations (mixed systems). Basic concepts in system theory, such as state variables and stability concepts, will be introduced as well as bond graph notation and approach. Prerequisites: ENME 2530, ENME 2661, ENGR 1572, and ENEE 2012.

ENME 2541 Mechanics of Materials (3 Credits)

Normal and shear stress and strain; elasticity, mechanical properties of materials, principal stresses; torsion, beams, deflection of beams under loads, methods of superposition, failure theory, columns. Prerequisite: ENME 2510.

ENME 2651 Fluid Dynamics I (3 Credits)

Course series provides students with the basic skill levels required to solve fluid-mechanics and heat transfer problems. Topics include hydrostatics, dimensional analysis, incompressible and compressible flows, conduction, convection and radiation. Students explore a variety of solution techniques such as control volume, differential analysis, boundary layer analysis, finite differencing and resistance network analogies. Prerequisite: ENME 2510 and MATH 2070.

ENME 2661 Fluid Dynamics II/Heat Transfer I (3 Credits)

Course series provides students with the basic skills levels required to solve fluid-mechanics and heat transfer problems. Topics include hydrostatics, dimensional analysis, incompressible and compressible flows, conduction, convection and radiation. Students explore a variety of solution techniques such as control volume, differential analysis, boundary layer analysis, finite differencing and resistance network analogies. Prerequisite: ENME 2651.

ENME 2671 Heat Transfer II with Lab (4 Credits)

Course series provides students with the basic skill levels required to solve fluid-mechanics and heat transfer problems. Topics include hydrostatics, dimensional analysis, incompressible and compressible flows, conduction, convection and radiation. Students explore a variety of solution techniques such as control volume, differential analysis, boundary layer analysis, finite differencing and resistance network analogies. Prerequisite: ENME 2661.

ENME 2710 Engineering Thermodynamics I (3 Credits)

Properties of a pure substance. Use of tables of properties. First and second laws of thermodynamics for closed and open systems. Work, heat, power and entropy. Engine, power plant and refrigeration cycles. Gas mixtures, thermodynamic relations and chemical reactions. Prerequisite: PHYS 1212.

ENME 2720 Engineering Thermodynamics II (3 Credits)

Properties of a pure substance. Use of tables of properties. First and second laws of thermodynamics for closed and open systems. Work, heat, power and entropy. Engine, power plant and refrigeration cycles. Gas mixtures, thermodynamic relations and chemical reactions. Prerequisite: ENME 2710.

ENME 2810 Mechanical Engineering Lab I (3 Credits)

Engineering experiments illustrating selected topics in heat transfer, fluid mechanics, solid mechanics, thermodynamics, measurement and control. Use of microcomputers in experimentation and control. This course encourages the development of laboratory experimentation skills, design skills and technical writing skills. Prerequisites: ENME 2540 AND ENME 2671.

ENME 3320 Computer Aided Design and Analysis (4 Credits)

Introduction to the use of computer aided design and analysis with applications to solid and fluid mechanics, heat transfer and vibrations; projects in one or more of the above areas. Emphasis on how to use the software to analyze engineering systems. Prerequisites ENME 2541 and ENME 2651.

ENME 3400 Fatigue (4 Credits)

A detailed overview of fatigue. Topics include: stress life and strain life approaches, fracture mechanics, constant amplitude and spectrum loading, life prediction, fatigue at notches, microstructural effects, environmentally assisted fatigue, retardation and acceleration, multi-axial fatigue, design against fatigue, and reliability. Cross listed with ENME 4400.

ENME 3511 Machine Design (3 Credits)

Application of statics, dynamics, mechanics of materials and manufacturing processes to the design of machine elements and systems. Properties of materials and design criteria. Synthesis and analysis of a machine design project. Prerequisites: ENME 2520 and ENME 2541.

ENME 3545 Mechanisms (4 Credits)

Synthesis, analysis and use of mechanisms. Mechanisms studied include cams, gears and planar linkages, with an emphasis on planar linkages. Prerequisites: ENME 2530 and ENGR 1572.

ENME 3651 Computational Fluid Dynamics (4 Credits)

This course introduces principles and applications of computational methods in fluid flow and topics chosen from heat transfer, mass transfer or two phase flow. The conservation equations, their discretations and solutions, are presented. Convergence and validity of solutions along with computational efficiency are explored. Students learn to apply these techniques using the latest software packages. Prerequisites: ENME 2671.

ENME 3661 Mechanical Energy Systems Engineering (4 Credits)

This course covers energy systems engineering analysis from a mechanical and materials engineering perspective. This course covers energy production from traditional energy systems that use fossil fuel combustion such as internal combustion engines, coal-fired plants, and natural gas turbines, to nuclear energy and renewable energy methods such as wind, solar, hydraulic, and geothermal. Lastly, the course will survey emerging technologies for future (21st century) energy systems. Students should have taken at a minimum Thermodynamics, Dynamics, and Fluid Dynamics courses. Prerequisites: ENME 2720, ENME 2510, ENME 2651.

ENME 3720 Aerospace Engineering: Atmospheric Flight Dynamics (4 Credits)

This course provides and introduction to aerospace engineering analysis and design. In the atmospheric domain, the basics of aerodynamics are covered, followed by flight mechanics. The approach is from a practical perspective in which analysis and design are intertwined. Prerequisites: ENME 2651 and ENME 2720 and ENME 2530.

ENME 3730 Aerospace Engineering: Space Flight Dynamics (4 Credits)

This course is focused on the aerospace discipline of space environment and orbital mechanics. The topics in this discipline are discussed in detail and provide aid in designing spacecraft/space missions. Some of the topics covered in this course include space environment, satellite orbits, spacecraft configurations, transfer orbits, and elementary space propulsion. Prerequisites: ENME 2651 and ENME 2720 and ENME 2530.

ENME 3810 Mechanical Engineering Capstone Laboratory (3 Credits)

This course is the capstone mechanical engineering laboratory course requiring independent experimental design by student teams. Using experimental equipment available in heat transfer, fluid mechanics, solid mechanics, thermodynamics, and measurement and control, the student team is required to design experiments to solve given problems which will be unique to each team. This course encourages students to develop experimental design and research techniques while continuing to improve skills in fundamental lab notebook keeping, uncertainty analysis in measurements, data acquisition, data analysis, report writing, oral presentations, and laboratory safety and procedures. Prerequisite: ENME 2810.

ENME 3820 Topics Mechanical Engineering (0-5 Credits)

Mechanical engineering topics as announced. May be taken more than once. Prerequisite: vary with offering.

ENME 3991 Independent Study (1-5 Credits)

Topics in mechanical engineering investigated under faculty supervision. May be taken more than once. Students must obtain and complete an Independent Study form from the Office of the Registrar. Prerequisite: permission of instructor.

ENME 3995 Independent Research (1-10 Credits)